

CLAIMS

1. A method for treating hardly-decomposable-substance-containing water, which comprises the steps of

5 (B) adding an adsorbent to water containing a hardly decomposable substance (treatment raw water) to cause the hardly decomposable substance to be adsorbed on said adsorbent (adsorption treatment step),

10 (C) separating a permeated liquid through a filter membrane to concentrate the adsorbent adsorbing said hardly decomposable substance (membrane filtering treatment step), and

15 (D) chemically decomposing the hardly decomposable substance adsorbed on said concentrated adsorbent with a peroxide without any operation of desorption from said adsorbent (chemical decomposition step).

2. The method for treating hardly-decomposable-substance-containing water as recited claim 1, wherein the
20 step (D) uses said peroxide in an amount of at least 100 times larger in molar relative to that of said hardly decomposable substance.

3. The method for treating hardly-decomposable-substance-containing water as recited in claim 1 or 2,
25 which further comprises the step of

(A) separating a permeated liquid from the water containing the hardly decomposable substance through a reverse osmosis membrane (RO membrane) or a nano-filter
30 membrane (NF membrane), to concentrate the hardly

decomposable substance (membrane concentrating treatment step).

4. The method for treating hardly-decomposable-
5 substance-containing water as recited in claim 1, which
further comprises the step of

(E) neutralizing chlorine in the water containing
the hardly decomposable substance (chlorine neutralization
step).

10 5. The method for treating hardly-decomposable-
substance-containing water as recited in claim 1, which
further comprises the step of

(F) carrying out irradiation with ultraviolet light
15 to decompose the hardly decomposable substance
(photodegradation step).

6. The method for treating hardly-decomposable-
substance-containing water as recited in claim 1, which
20 comprises the step of

(G) backwashing the filter membrane used in said
step (C), to free the adsorbent adsorbing the hardly
decomposable substance from said filter membrane (backwash
step).

25 7. The method for treating hardly-decomposable-
substance-containing water as recited in claim 1, which
further comprises the step of

(H) adding a flocculating agent to water containing
30 the adsorbent adsorbing the hardly decomposable substance,

to flocculate and separate the adsorbent adsorbing the hardly decomposable substance (flocculation separation step).

5 8. The method for treating hardly-decomposable-substance-containing water as recited in claim 1, wherein the adsorbent to be added in said step (B) is one inorganic adsorbent, or two or more inorganic adsorbents, which is or are selected from the group consisting of titanium dioxide,
10 zeolite, acid clay, activated clay, diatomite, metal oxide, metal powder, activated carbon and carbon black.

9. The method for treating hardly-decomposable-substance-containing water as recited in claim 8, wherein
15 the adsorbent to be added in said step (B) is titanium dioxide.

10 The method for treating hardly-decomposable-substance-containing water as recited in claim 1, wherein
20 the filter membrane for use in said step (C) is selected from the group consisting of an ultrafilter membrane (UF membrane), a nano-filter membrane (NF membrane), a microfiltration membrane (MF membrane) and a reverse osmosis membrane (RO membrane).

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11 The method for treating hardly-decomposable-substance-containing water as recited in claim 1, wherein the peroxide for use in said step (D) is a persulfate.

30 12 A method for treating hardly-decomposable-

substance-containing water as recited in claim 1, wherein at least part of the hardly decomposable substance concentrated in said step (A) and/or the adsorbent adsorbing the hardly decomposable substance concentrated in said step (C) is returned to the water containing the hardly decomposable substance (treatment raw water) or a step upstream of the step (A) or the step (C).

13 An apparatus for treating hardly-decomposable-
10 substance-containing water, which comprises
 an adsorbent adding section for adding an adsorbent to water containing a hardly decomposable substance (treatment raw water),
 a membrane filtering treatment section for
15 separating a permeated liquid through a filter membrane to concentrate the adsorbent adsorbing said hardly decomposable substance, and
 a chemical decomposition treatment section for oxidation-decomposing said hardly decomposable substance
20 adsorbed on said adsorbent with a peroxide.

14 An apparatus for treating hardly-decomposable-
substance-containing water, comprising
 a reducing substance introduction section for
25 introducing a reducing substance to water containing a hardly decomposable substance (treatment raw water) to neutralize chlorine in said water,
 a membrane concentrating treatment section for separating a permeated liquid from the water containing a
30 hardly decomposable substance through a reverse osmosis

membrane (RO membrane) or a nano-filter membrane (NF membrane) to concentrate the hardly decomposable substance,

an adsorbent adding section for adding an adsorbent to said hardly decomposable substance concentrated, to
5 cause the adsorbent to adsorb the hardly decomposable substance,

a membrane filtering treatment section for separating a permeated liquid through a filter membrane to concentrate the adsorbent adsorbing said hardly
10 decomposable substance,

a flocculating agent adding section for adding a flocculating agent to water containing the adsorbent adsorbing said concentrated hardly decomposable substance, to flocculate the adsorbent adsorbing said hardly
15 decomposable substance,

a solid-liquid separating section for separating the adsorbent adsorbing the hardly decomposable substance and being flocculated by said flocculating agent, and

a chemical decomposition treatment section for
20 oxidation-decomposing the hardly decomposable substance adsorbed on said adsorbent separated, with a peroxide.

15 A method for concentrating a hardly decomposable substance in hardly-decomposable-substance-containing water,
25 which comprises the steps of

(B) adding an adsorbent to water containing a hardly decomposable substance (treatment raw water) to cause the hardly decomposable substance to be adsorbed on said adsorbent (adsorption treatment step), and

30 (C) separating a permeated liquid through a filter

membrane to concentrate the adsorbent adsorbing said hardly decomposable substance (membrane filtering treatment step).

16 The method for concentrating a hardly decomposable
5 substance in hardly-decomposable-substance-containing water
as recited in claim 15, which further comprises the step of

(A) separating a permeated liquid from the water
containing a hardly decomposable substance through a
reverse osmosis membrane (RO membrane) or a nano-filter
10 membrane (NF membrane), to concentrate the hardly
decomposable substance (membrane concentrating treatment
step).

17 The method for concentrating a hardly decomposable
15 substance in hardly-decomposable-substance-containing water
as recited in claim 16, wherein at least part of the hardly
decomposable substance concentrated in said step (A) is
returned to said water containing a hardly decomposable
substance (treatment raw water).

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[18] A method for treating water containing a hardly
decomposable substance, which comprises irradiating a
hardly decomposable substance concentrated by the method
for concentrating a hardly decomposable substance in
25 hardly-decomposable-substance-containing water as recited
in any one of claim 15 to 17, with light to decompose the
hardly decomposable substance.